FACTORS AFFECTING RISK JUDGMENTS

Studies have been conducted to discover what factors people link with risk. One such study indicates that we consider whether the risk is controllable, voluntary, fatal, catastrophic, dreaded, or even known.

Part I

In this exercise, rank each activity or technology considering two separate factors. Using a scale from 1-9, with 1 being low and 9 being high, determine a value for Factor 1 and a value for Factor 2 for each activity or technology listed below. When you have completed your rankings, you will plot the results on the grid entitled *Location of Hazards*.

ACTIVITY	FACTOR 1 *1...9* *controllable or uncontrollable?* *voluntary or involuntary?* *not fatal or fatal?*	FACTOR 2 *1...9* *observable or unobservable?* *known or unknown?* *immediate effects or delayed effects?*
Autos		
Handguns		
Alcohol		
Swimming		
Vaccination		
Antibiotics		
X-ray		
Football		
Bicycling		
Nuclear power		
Pesticides		
Electric power (non-nuclear)		

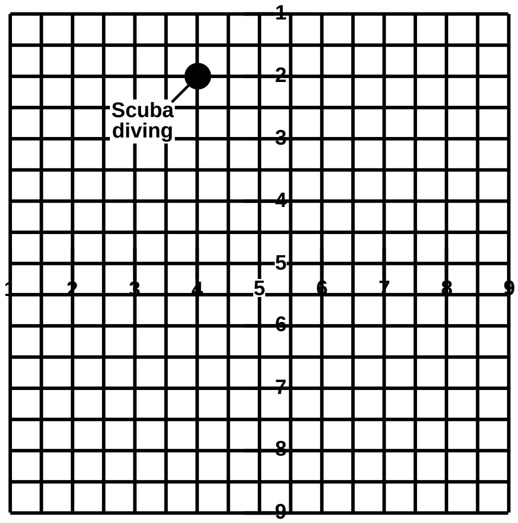
LOCATION OF HAZARDS

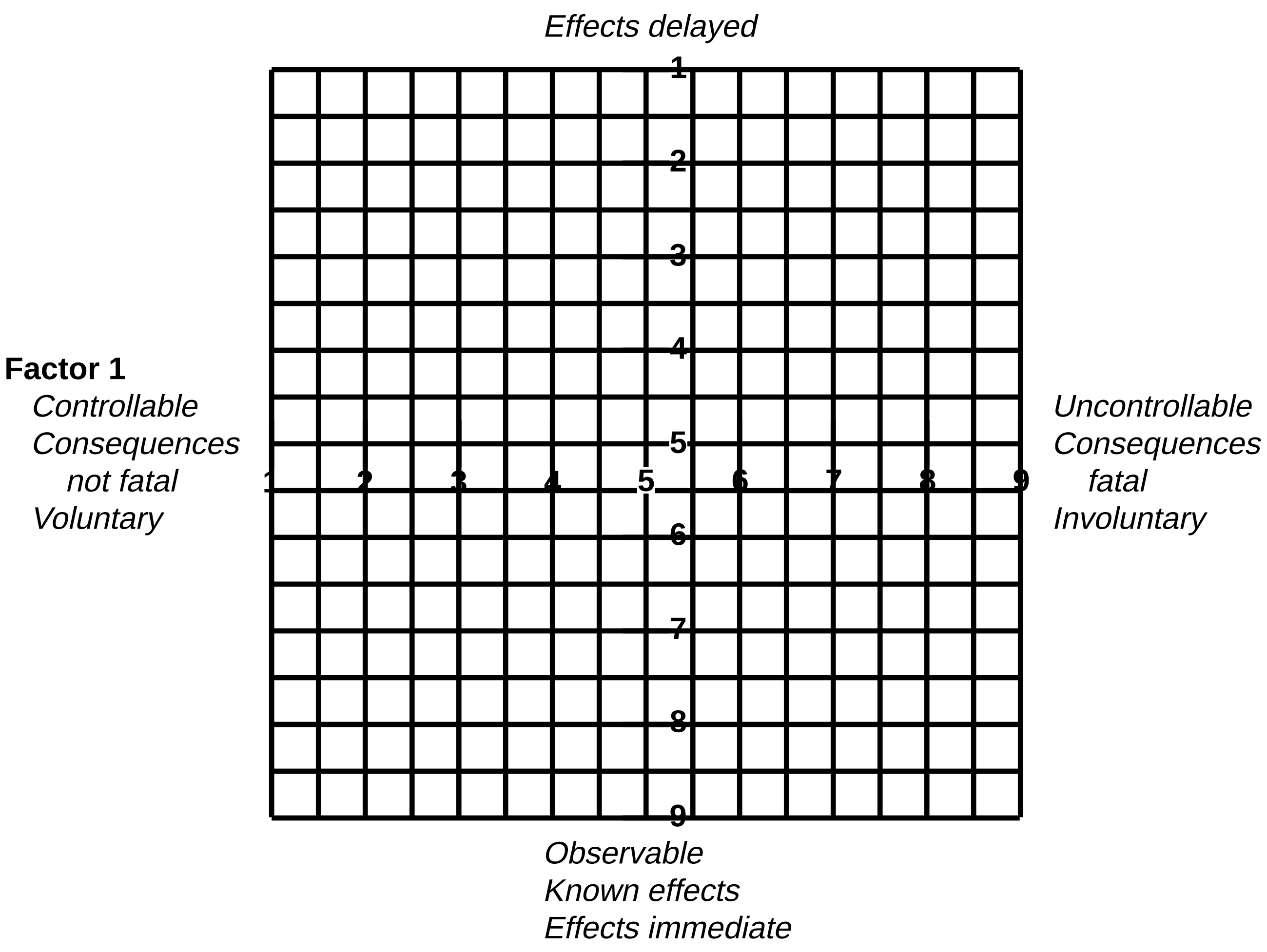
Part II

Directions: Plot the results of your ranking on the activity entitled *Factors Affecting Risk Judgments.*

1. Mark the intersection of Factor 1 and Factor 2.
2. Label the point with the appropriate activity or technology.

Example:





PROBABILITY EXERCISES

Things to Remember:

- The probability of any outcome is the number of times that outcome can occur divided by the total number of outcomes.
- If there are n equally likely outcomes to one event, then the probability of each outcome is 1 divided by n, $\left(\frac{1}{n}\right)$.
- To determine the probability that any of several outcomes will occur for one event, such as the draw of **one** card, **one** spin of the roulette wheel, etc., **add** the separate probabilities together.
- To determine the probability of two separate events occurring at the same time, **multiply** the separate probabilities together.

Conversions:

Fraction to decimal

$\frac{3}{20} = 3 \div 5 = 0.6$

$\frac{3}{20} = 3 \div 20 = 0.15$

Decimal to fraction

0.1 = 1/10	1 in ten
0.01 = 1/100	1 in a hundred
0.001 = 1/1000	1 in a thousand

Percent to probability

$50\% = \frac{50}{100} = 0.50$ probability

Probability to percent

0.50 probability = 0.50 x 100 = 50%
0.35 probability = 0.35 x 100 = 35%

Convert to a fraction.

a. 0.25 =
b. 0.60 =
c. 0.934 =

Convert from percent to probability.

a. 25% =
b. 33% =
c. 75% =

Convert from probability to percent.

a. 0.2 =
b. 0.64 =
c. 0.934 =

Exercises

1. In flipping a coin six times, the following sequence was observed: H,T,T,T,T,T. What is the probability that on the seventh flip the coin will come up tails?

2. Draw one card from an ordinary deck of cards. (Express answers as fractions and decimals.)

   a) What is the probability that it is the Queen of Hearts?

   b) What is the probability that it is either the King or the Queen of Hearts?

3. Draw two cards from an ordinary deck. What is the probability of getting both the King and Queen of Hearts?

4. Draw five cards. What is the probability of drawing the A,K,Q,J,10 of Hearts? What is the probability of drawing any royal flush?

5. Two basketball teams of equal skill are involved in a four game tournament. What is the probability of one of the teams winning the tournament in four straight games?

PROBABILITY EXERCISES

Challenge Level

1. A typical roulette wheel has 38 slots that are numbered 1, 2, 3,..., 34, 35, 36, 0, and 00. The 0 and 00 slots are green. Of the remaining slots, half are red and half are black. Also half of the integers from 1 to 36 are even and half are odd. 0 and 00 are defined as neither even or odd. A ball is rolled around the wheel and ends up in one of the slots. We assume that each slot has an equal chance.

   a) What is the probability of each slot?

   b) What is the probability of the ball landing in a green slot? A red slot? A black slot?

   c) What is the probability of the ball landing on an even number?

   d) What is the probability of getting a 1, 12, 24, or 36?

For the following questions, to calculate the “expected” value of an event multiply the consequence (profit or loss) under each outcome by the probability of the outcome and add them together. For example, if you bet $1.00 on the flip of a coin, there is a 0.50 probability that you win and a 0.50 probability that you lose. The expected value of this game is 0.50($1.00) + 0.50(0) = $.50 + $0 = $0.50

2. In a particular lottery 2,000,000 tickets are sold each week for $0.50 each. Each week there are 12,009 tickets drawn and awarded prizes: 12,000 people receive $25; 6 people win $10,000; 2 people win $50,000; and 1 person wins $200,000.

   a) Determine the probability of winning each prize.

   b) If you play this game, what is your “expected” payoff?

3. Suppose you must choose between two products (A and B) to sell in your shop. Your choice depends on what the economy is going to do. If the economy goes up, you will make a profit of $100,000 on product A or $60,000 on product B. If the economy stays the same, you will earn a profit of $50,000 on product A and $40,000 on product B. And if the economy goes down, you will lose $20,000 on product A but can still earn $10,000 on product B.

You don’t know for sure what the economy is going to do, but you might know the probabilities of these things happening. Suppose the probability of the economy going up is 0.4, the probability of it staying the same is 0.4, and the probability of it going down is 0.2.

Determine the expected profit for each product. Which product would you choose and why?

METRIC AND U.S. UNIT CONVERSIONS

Both metric and U.S. equivalent units have been used in this curriculum, as appropriate to the issues being discussed. For example, inventories of spent fuel are routinely reported in the United States in terms of metric tons,* even though most Americans are familiar with the short ton (2,000 pounds). Classroom experiments are usually conducted using metric units as well. Yet the standards and tests for spent fuel transportation casks are written using temperature in degrees Fahrenheit, miles per hour, and other similar units.

While the United States is working to increase its use of the metric system, both systems will be used during the transition period. To familiarize yourself with potentially unfamiliar metric units, conversion charts are provided here. Use Table 1 to convert a metric unit into its U.S. equivalent. To convert an U.S. unit into its metric equivalent, use Table 2.

For example, using Table 1 to convert 1,000 kilograms into its equivalent in pounds, multiply by 2.205 to get 2,205 pounds (1,000 kg X 2.205 lb/kg = 2,205 lb). Alternately, using Table 2, 2,000 pounds is equivalent to 907.2 kilograms (2,000 lb X 0.4536 kg/lb).

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* One metric ton is equal to 1,000 kilograms (or 2,205 pounds).

Table 1. Approximate Conversions from Metric to English Units

If you know...

Length	**multiply by**	**to get**
millimeters (mm)	0.03937	inches (in)
centimeters (cm)	0.03281	feet (ft)
centimeters (cm)	0.3937	inches (in)
meters (m)	39.37	inches (in)
meters (m)	3.281	feet (ft)
meters (m)	1.094	yards (yd)
kilometers (km)	3,281.0	feet (ft)
kilometers (km)	0.5396	nautical miles (mi)
kilometers (km)	0.6214	statute miles (mi)
Area		
hectares (ha)	2.471	acres
hectares (ha)	1.076 X 105	square ft (ft^2)
Weight (mass)		
grams (gm)	0.03527	ounces (oz)
grams (gm)	0.002205	pounds (lb)
kilograms (kg)	2.205	pounds (lb)
metric tons (t)	1.102	short tons
metric tons (t)	0.984	long tons
Pressure		
kilopascals (kPa)	6.9	pounds/square inch (lb/in^2)
Volume		
cubic centimeters (cm^3)	0.06202	cubic inches (in^3)
cubic meters (m^3)	3.531	cubic feet (ft^3)
cubic meters (m^3)	1.307	cubic yards (yd^3)
liters (L)	2.113	pints* (pt)
liters(L)	0.2642	gallons* (gal)
Temperature		
Celsius	9/5, [then add 32]	Fahrenheit
Electric Current		
ampere (A)	1	ampere (A)
Energy, Work, Heat		
joule (J)	9.480 x 10^{-4}	BTU
Power		
watt (W)	1	watt (W)
watt (W)	3.4129	BTU per hour
watt (W)	1.341 x 10^{-3}	horsepower

Common Prefixes for Metric Units:

mega = million = 10^6
kilo = thousand
hecto = hundred
deka = ten

deci = one-tenth
centi = one-hundredth
milli = one-thousandth
micro = one-millionth

Examples:
kilogram = 1,000 grams
milliliter = 1/1,000 liter

*liquid measure

Table 2. Approximate Conversions from English to Metric Units

If you know...

Length	**multiply by**	**to get**
inches (in)	2.54	centimeters (cm)
feet (ft)	30.48	centimeters (cm)
feet (ft)	0.3048	meters (m)
miles (mi)	1.609	kilometers (km)
yards (yd)	0.9144	meters (m)
Area		
square inches (in^2)	6.5	square centimeters (cm^2)
square feet (ft^2)	0.09	square meters (m^2)
square yards (yd^2)	0.8	square meters (m^2)
acres	0.4047	hectares (ha)
square miles (mi^2)	2.6	square kilometers (k^2)
Weight (mass)		
ounces (oz)	28.349527	grams (gm)
pounds (lb)	0.4536	kilograms (kg)
tons (long)	1.016	metric ton (t)
Pressure		
pounds per square inch	70.31	grams per square centimeter
pounds per square inch	0.145	kilopascals
Volume		
cubic feet (ft^3)	0.02832	cubic meters (m^3)
cubic inches (in^3)	16.387	cubic centimeters (cm^3)
cubic yards (yd^3)	0.765	cubic meters (m^3)
gallons* (gal)	3.785	liters (L)
pints* (pt)	0.473	liters (L)
quarts* (qt)	0.946	liters (L)
Temperature		
Fahrenheit	[subtract 32, then multiply by 5/9]	Celsius
Electric Current		
ampere (A)	1	ampere (A)
Energy, Work, Heat		
BTU	1,055	joules (J)
Power		
watt (W)	1	watt (W)
BTU per hour	0.293	watt (W)
horsepower	745.712	watt (W)

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*liquid measure